

What is claimed is:

1. A computer-implemented method for use in a printer, the method comprising steps of:

- (A) receiving a representation of a subset of an image printed by the printer;
- 5 (B) identifying a first pattern in the subset of the image, the first pattern encoding a position of the subset along an axis of the image;
- (C) identifying the position of the subset
10 along the axis of the image based on the first pattern; and
- (D) estimating a color misregistration along the axis of the image based on the position of the subset along the axis of
15 the image.

2. The method of claim 1, wherein the step (D) comprises steps of:

- (D) (1) identifying an expected distance between a first shape having a first color and a
5 second shape having a second color in the subset of the image based on the position of the subset along the axis of the image;
- (D) (2) estimating an actual distance between the
10 first and second shapes based on the representation of the subset of the image; and

(D) (3) estimating the color misregistration
 along the axis of the image as the
15 difference between the expected distance
 and the estimate of the actual distance
 between the first and second shapes.

3. The method of claim 1, wherein the printer is a
tandem printer and wherein the axis of the image runs in
a cross-web direction of the image.

4. The method of claim 1, wherein the first pattern
comprises a subset of a second pattern having a
plurality of zones containing a plurality of unique sub-
patterns, and wherein step (C) comprises steps of:

5 (C) (1) identifying one of the plurality of
 unique sub-patterns in the first
 pattern; and
 (C) (2) identifying the position of the
 subset along the axis of the image
10 based on the sub-pattern identified
 in step (C) (1).

5. The method of claim 4, wherein the second
pattern comprises a plurality of lines running parallel
to a second axis of the image and a plurality of shapes
abutting the plurality of lines, and wherein the step
5 (C) (1) comprises a step of identifying one of the
plurality of unique sub-patterns in the first pattern by
matching a pattern of abutting shapes in the subset of
the image to a pattern of abutting shapes in the first
pattern.

6. The method of claim 1, wherein the printer
comprises a first print head for printing at a first

resolution and a second print head for printing at a second resolution that differs from the first
5 resolution, wherein the second pattern comprises a plurality of shapes printed by the first and second print heads, and wherein each of the plurality of shapes is printed solely by a single one of the first and second print heads.

7. A computer-implemented method for use in a tandem printer comprising a first print head for printing at a first resolution and a second print head for printing at a second resolution that differs from
5 the first resolution, the method comprising steps of:

- (A) receiving a representation of a subset of an image printed by the printer;
- (B) identifying a first pattern in the subset of the image, the first pattern encoding a position of the subset along an axis of
10 the image, the axis running in a cross-web direction of the image, the first pattern comprising a subset of a second pattern having a plurality of zones containing a plurality of unique sub-patterns;
- (C) identifying the position of the subset along the axis of the image based on the first pattern by performing steps of:
 - (1) identifying one of the plurality of
20 unique sub-patterns in the first pattern; and
 - (2) identifying the position of the subset along the axis of the image based on the identified sub-pattern;

25 (D) estimating a color misregistration along
the axis of the image based on the
position of the subset along the axis of
the image by performing steps of:

30 (1) identifying an expected distance between
a first shape having a first color and a
second shape having a second color in the
subset of the image based on the position of
the subset along the axis of the image;

35 (2) estimating an actual distance between the
first and second shapes based on the
representation of the subset of the image; and

40 (3) estimating the color misregistration
along the axis of the image as the difference
between the expected distance and the estimate
of the actual distance between the first and
second shapes.

8. The method of claim 7, wherein the second
pattern comprises a plurality of lines running parallel
to a second axis of the image and a plurality of shapes
abutting the plurality of lines, and wherein the step

5 (C)(1) comprises a step of identifying one of the
plurality of unique sub-patterns in the first pattern by
matching a pattern of abutting shapes in the subset of
the image to a pattern of abutting shapes in the first
pattern.

9. A printer comprising:

means for receiving a representation of a subset of
an image printed by the printer;

first identification means for identifying a first
5 pattern in the subset of the image, the first pattern
encoding a position of the subset along an axis of the
image;

second identification means for identifying the
position of the subset along the axis of the image based
10 on the first pattern; and

means for estimating a color misregistration along
the axis of the image based on the position of the
subset along the axis of the image.

10. The printer of claim 9, wherein the means for
estimating comprises:

means for identifying an expected distance between
a first shape having a first color and a second shape
5 having a second color in the subset of the image based
on the position of the subset along the axis of the
image;

means for estimating an actual distance between the
first and second shapes based on the representation of
10 the subset of the image; and

means for estimating the color misregistration
along the axis of the image as the difference between
the expected distance and the estimate of the actual
distance between the first and second shapes.

11. The printer of claim 9, wherein the first
pattern comprises a subset of a second pattern having a
plurality of zones containing a plurality of unique sub-
patterns, and wherein the second identification means
5 comprises:

means for identifying one of the plurality of unique sub-patterns in the first pattern; and

means for identifying the position of the subset along the axis of the image based on the sub-pattern identified in step (C)(1).

12. The printer of claim 11, wherein the second pattern comprises a plurality of lines running parallel to a second axis of the image and a plurality of shapes abutting the plurality of lines, and wherein the second identification means further comprises means for identifying one of the plurality of unique sub-patterns in the first pattern by matching a pattern of abutting shapes in the subset of the image to a pattern of abutting shapes in the first pattern.

13. The printer of claim 9, wherein the printer comprises a first print head for printing at a first resolution and a second print head for printing at a second resolution that differs from the first resolution, wherein the second pattern comprises a plurality of shapes printed by the first and second print heads, and wherein each of the plurality of shapes is printed solely by a single one of the first and second print heads.

14. A data structure tangibly embodied in a computer readable-medium and suitable for printing as a calibration image for use in performing color registration correction in a multi-color printer, the data structure representing an image having a first axis, the image comprising a plurality of regions positioned along the first axis, the plurality of

regions comprising a plurality of patterns, each pattern
P in the plurality of patterns encoding the position of
10 pattern *P* along the first axis.

15. The data structure of claim 14, wherein the
plurality of patterns comprises:

a plurality of lines positioned along the first
axis and running parallel to a second axis of the image;
5 and

a plurality of shapes abutting the plurality of
lines.

16. The data structure of claim 15, wherein the
printer comprises a plurality of print heads, wherein
the plurality of lines have a plurality of colors, and
wherein each of the plurality of lines has a single
5 color suitable for printing by a single print head in
the printer.

17. The data structure of claim 16, wherein the
plurality of lines includes at least one line of each of
the colors printable by a single one of the plurality of
print heads.

18. The data structure of claim 15, wherein each of
the plurality of lines is exactly one pixel wide, and
wherein each of the plurality of abutting shapes is
exactly one pixel wide.

19. A data structure tangibly embodied in a
computer readable-medium and suitable for printing as a
calibration image for use in performing color
registration correction in a multi-color printer
5 comprising a plurality of print heads, the data
structure representing an image having a first axis, the

image comprising a plurality of regions positioned along the first axis, the plurality of regions comprising a plurality of patterns, each pattern *P* in the plurality
10 of patterns encoding the position of pattern *P* along the first axis, the plurality of patterns comprising: (1) a plurality of lines positioned along the first axis and running parallel to a second axis of the image; and (2) a plurality of shapes abutting the plurality of lines,
15 wherein the plurality of lines have a plurality of colors, and wherein each of the plurality of lines has a single color suitable for printing by a single print head in the printer.

20. A computer-implemented method for use in a printer comprising a first print head for printing at a first resolution and a second print head for printing at a second resolution that differs from the first
5 resolution, the method comprising steps of:

- (A) receiving a representation of a subset of an image printed by the printer;
- (B) identifying, in the subset of the image, a first shape printed by the first print
10 head;
- (C) identifying, in the subset of the image, a second shape printed by the second print head;
- (D) estimating locations of the first and
15 second shapes along the first axis of the image based on the representation of the subset of the image; and

20 (E) estimating a color misregistration along
the first axis of the image as the
difference between the location of the
first shape and the location of the second
shape along the first axis of the image.

21. The method of claim 20, wherein the printer is
a tandem printer and wherein the first axis runs in a
down-web direction of the image.

22. The method of claim 20, wherein the step (D)
comprises steps of:

- (D) (1) identifying a center of the first shape
along the first axis;
- 5 (D) (2) identifying a center of the second shape
along the first axis;
- (D) (3) estimating the location of the first
shape as the identified center of the
first shape; and
- 10 (D) (4) estimating the location of the second
shape as the identified center of the
second shape.

23. The method of claim 20, wherein the first shape
consists of a first pixel printed by the first print
head and wherein the second shape consists of a second
pixel printed by the second print head.

24. A computer-implemented method for use in a
tandem printer comprising a first print head for
printing at a first resolution and a second print head
for printing at a second resolution that differs from
5 the first resolution, the method comprising steps of:

- (A) receiving a representation of a subset of an image printed by the printer;
- (B) identifying, in the subset of the image, a first shape printed by the first print head;
- 10 (C) identifying, in the subset of the image, a second shape printed by the second print head;
- 15 (D) estimating locations of the first and second shapes along a first axis of the image based on the representation of the subset of the image, the first axis running in a down-web direction of the printer, by performing steps of:
- 20 (1) identifying a center of the first shape along the first axis;
- (2) identifying a center of the second shape along the first axis;
- (3) estimating the location of the first shape as the identified center of the first shape; and
- 25 (4) estimating the location of the second shape as the identified center of the second shape.
- 30 (E) estimating a color misregistration along the first axis of the image as the difference between the location of the first shape and the location of the second shape along the first axis of the image.

25. A printer comprising:
a first print head for printing at a first resolution;
a second print head for printing at a second resolution that differs from the first resolution;
5 means for receiving a representation of a subset of an image printed by the printer;
first identification means for identifying, in the subset of the image, a first shape printed by the first
10 print head;
second identification means for identifying, in the subset of the image, a second shape printed by the second print head;
means for estimating locations of the first and
15 second shapes along the first axis of the image based on the representation of the subset of the image; and
means for estimating a color misregistration along the first axis of the image as the difference between the location of the first shape and the location of the
20 second shape along the first axis of the image.

26. The printer of claim 25, wherein the printer comprises a tandem printer and wherein the first axis runs in a down-web direction of the image.

27. The printer of claim 25, wherein the first identification means comprises:
means for identifying a center of the first shape along the first axis;
5 means for identifying a center of the second shape along the first axis;

means for estimating the location of the first
shape as the identified center of the first shape; and
means for estimating the location of the second
10 shape as the identified center of the second shape.

28. A computer-implemented method for use in a
printer, the method comprising steps of:

- 5 (A) receiving a representation of a subset of
an image printed by the printer, the
subset of the image comprising a first
plurality of shapes printed by the first
and second print heads;
- (B) identifying a position of the subset along
a first axis of the image;
- 10 (C) identifying an expected distance between a
first one of the first plurality of shapes
printed by the first print head and a
second one of the first plurality of
shapes printed by the second print head
15 based on the position of the subset along
the first axis of the image;
- (D) estimating an actual distance between the
first and second shapes based on the
representation of the subset of the image;
- 20 (E) estimating a first color misregistration
along the first axis as the difference
between the expected distance and the
estimated actual distance between the
first and second shapes;

25 (F) identifying, in the subset of the image, a
 third shape printed by the first print
 head;
 (G) identifying, in the subset of the image, a
 fourth shape printed by the second print
30 head;
 (H) estimating locations of the third and
 fourth shapes along a second axis of the
 subset of the image based on the
 representation of the subset of the image;
35 and
 (I) estimating a second color misregistration
 along the second axis as the difference
 between the location of the third shape
 and the location of the fourth shape along
40 the second axis of the image.

29. The method of claim 28, further comprising a
step of:

(J) prior to the step (A), printing the image.

30. The method of claim 28, further comprising
steps of:

 (J) generating a first misregistration
 correction based on the first color
5 misregistration;
 (K) generating a second misregistration
 correction based on the second color
 misregistration; and
 (L) applying the first and second
10 misregistration corrections to a
 subsequent image printed by the printer.

31. A printer comprising:

means for receiving a representation of a subset of
an image printed by the printer, the subset of the image
comprising a first plurality of shapes printed by the
5 first and second print heads;

means for identifying a position of the subset
along a first axis of the image;

means for identifying an expected distance between
a first one of the first plurality of shapes printed by
10 the first print head and a second one of the first
plurality of shapes printed by the second print head
based on the position of the subset along the first axis
of the image;

means for estimating an actual distance between the
15 first and second shapes based on the representation of
the subset of the image;

means for estimating a first color misregistration
along the first axis as the difference between the
expected distance and the estimated actual distance
20 between the first and second shapes;

means for identifying, in the subset of the image,
a third shape printed by the first print head;

means for identifying, in the subset of the image,
a fourth shape printed by the second print head;

25 means for estimating locations of the third and
fourth shapes along a second axis of the subset of the
image based on the representation of the subset of the
image; and

means for estimating a second color misregistration
30 along the second axis as the difference between the

location of the third shape and the location of the fourth shape along the second axis of the image.

32. The printer of claim 28, further comprising:

means for generating a first misregistration correction based on the first color misregistration;

5 means for generating a second misregistration correction based on the second color misregistration;
and

means for applying the first and second misregistration corrections to a subsequent image printed by the printer.